

CLAIMS

WHAT IS CLAIMED:

1. A method for determining grid dimensions, comprising:
providing a wafer having a test structure comprising a plurality of intersecting lines
5 that define a grid having openings;
illuminating at least a portion of the grid with a light source;
measuring light reflected from the illuminated portion of the grid to generate a
reflection profile; and
determining a dimension of the grid based on the reflection profile.

10 2. The method of claim 1, wherein determining the dimension of the grid further
comprises:
comparing the generated reflection profile to a library of reference reflection profiles,
each reference reflection profile having an associated grid dimension metric;
15 selecting a reference reflection profile closest to the generated reflection profile; and
determining the dimension of the grid based on the grid dimension metric associated
with the selected reference reflection profile.

20 3. The method of claim 1, further comprising determining at least one parameter
of an operating recipe of a etch tool adapted to etch a subsequent wafer based on the
determined grid dimension.

25 4. The method of claim 3, wherein determining at least one parameter of the
operating recipe of the etch tool comprises determining at least one of an etch time parameter,
a plasma chemical composition parameter, an RF power parameter, a gas flow parameter, a

chamber temperature parameter, a chamber pressure parameter, and an end-point signal parameter.

5 5. The method of claim 1, further comprising determining at least one parameter of an operating recipe of a photolithography tool adapted to process a subsequent wafer based on the determined grid dimension.

10 6. The method of claim 5, wherein determining at least one parameter of the operating recipe of the photolithography tool comprises determining at least one of an exposure time parameter, an exposure dose parameter, a depth of focus parameter, a resist spin speed parameter, a soft bake temperature parameter, a post exposure bake temperature parameter, a cool plate temperature parameter, a developer temperature parameter, and a focus tilt parameter.

15 7. The method of claim 1, wherein generating the reflection profile comprises generating the reflection profile based on at least one of intensity and phase of the reflected light.

20 8. The method of claim 1, wherein determining the dimension of the grid further comprises:

comparing the generated reflection profile to a target reflection profile; and

determining the dimension of the grid based on the comparison of the generated reflection profile and the target reflection profile.

9. The method of claim 1, further comprising identifying a fault condition associated with the grid based on the determined grid dimension.

10. The method of claim 1, wherein determining the dimension of the grid further comprises determining at least one of a width dimension, a depth dimension, and a sidewall angle dimension.

11. A method for determining grid dimensions, comprising:
providing a wafer having a test structure comprising a plurality of intersecting lines
that define a grid having openings;
illuminating at least a portion of the grid with a light source;
measuring light reflected from the illuminated portion of the grid to generate a reflection profile;
comparing the generated reflection profile to a library of reference reflection profiles,
each reference reflection profile having an associated grid dimension metric;
selecting a reference reflection profile closest to the generated reflection profile; and
determining a dimension of the grid based on the grid dimension metric associated with the selected reference reflection profile.

12. The method of claim 11, further comprising determining at least one parameter of an operating recipe of a etch tool adapted to etch a subsequent wafer based on the determined grid dimension.

13. The method of claim 12, wherein determining at least one parameter of the operating recipe of the etch tool comprises determining at least one of an etch time parameter,

a plasma chemical composition parameter, an RF power parameter, a gas flow parameter, a chamber temperature parameter, a chamber pressure parameter, and an end-point signal parameter.

5 14. The method of claim 11, further comprising determining at least one parameter of an operating recipe of a photolithography tool adapted to process a subsequent wafer based on the determined grid dimension.

10 15. The method of claim 14, wherein determining at least one parameter of the operating recipe of the photolithography tool comprises determining at least one of an exposure time parameter, an exposure dose parameter, a depth of focus parameter, a resist spin speed parameter, a soft bake temperature parameter, a post exposure bake temperature parameter, a cool plate temperature parameter, a developer temperature parameter, and a focus tilt parameter.

15 16. The method of claim 11, wherein generating the reflection profile comprises generating the reflection profile based on at least one of intensity and phase of the reflected light.

20 17. The method of claim 11, further comprising identifying a fault condition associated with the grid based on the determined grid dimension.

25 18. The method of claim 11, wherein determining the dimension of the grid further comprises determining at least one of a width dimension, a depth dimension, and a sidewall angle dimension.

19. A method for determining grid dimensions, comprising:

providing a wafer having a test structure comprising a plurality of intersecting lines
that define a grid having openings;

5 illuminating at least a portion of the grid with a light source;

measuring light reflected from the illuminated portion of the grid to generate a
reflection profile; and

comparing the generated reflection profile to a target reflection profile; and

determining a dimension of the grid based on the comparison of the generated
reflection profile and the target reflection profile.

20. The method of claim 19, further comprising determining at least one
parameter of an operating recipe of a etch tool adapted to etch a subsequent wafer based on
the determined grid dimension.

21. The method of claim 20, wherein determining at least one parameter of the
operating recipe of the etch tool comprises determining at least one of an etch time parameter,
a plasma chemical composition parameter, an RF power parameter, a gas flow parameter, a
chamber temperature parameter, a chamber pressure parameter, and an end-point signal
parameter.

22. The method of claim 19, further comprising determining at least one
parameter of an operating recipe of a photolithography tool adapted to process a subsequent
wafer based on the determined grid dimension.

23. The method of claim 22, wherein determining at least one parameter of the operating recipe of the photolithography tool comprises determining at least one of an exposure time parameter, an exposure dose parameter, a depth of focus parameter, a resist spin speed parameter, a soft bake temperature parameter, a post exposure bake temperature
5 parameter, a cool plate temperature parameter, a developer temperature parameter, and a focus tilt parameter.

24. The method of claim 19, wherein generating the reflection profile comprises generating the reflection profile based on at least one of intensity and phase of the reflected
10 light.

25. The method of claim 19, further comprising identifying a fault condition associated with the grid based on the determined grid dimension.

26. The method of claim 19, wherein determining the dimension of the grid further comprises determining at least one of a width dimension, a depth dimension, and a
15 sidewall angle dimension.

27. A metrology tool adapted to receive a wafer having a test structure comprising
20 a plurality of intersecting lines that define a grid having openings, comprising:
a light source adapted to illuminate at least a portion of the grid;
a detector adapted to measure light reflected from the illuminated portion of the grid
to generate a reflection profile; and
a data processing unit adapted to determine a dimension of the grid based on the
25 reflection profile.

28. The metrology tool of claim 27, wherein the data processing unit is further adapted to compare the generated reflection profile to a library of reference reflection profiles, each reference reflection profile having an associated grid dimension metric, select a reference reflection profile closest to the generated reflection profile, and determine the dimension of the grid based on the grid dimension metric associated with the selected reference reflection profile.

29. The metrology tool of claim 27, wherein the detector is further adapted to generate the reflection profile based on at least one of intensity and phase of the reflected light.

30. The metrology tool of claim 27, wherein the metrology tool comprises at least one of a scatterometer, an ellipsometer, and a reflectometer.

31. The metrology tool of claim 27, wherein the data processing unit is further adapted to compare the generated reflection profile to a target reflection profile and determine the dimension of the grid based on the comparison of the generated reflection profile and the target reflection profile.

32. A processing line, comprising:
a processing tool adapted to process wafers in accordance with an operating recipe;
a metrology tool adapted to receive a wafer having a test structure comprising a plurality of intersecting lines that define a grid having openings, the metrology tool comprising:

a light source adapted to illuminate at least a portion of the grid;
a detector adapted to measure light reflected from the illuminated
portion of the grid to generate a reflection profile; and
a data processing unit adapted to determine a dimension of the grid
based on the reflection profile; and

a controller adapted to determine at least one parameter of the operating recipe of the
processing tool based on the determined grid dimension.

33. The processing line of claim 32, wherein the data processing unit is further
adapted to compare the generated reflection profile to a library of reference reflection
profiles, each reference reflection profile having an associated grid dimension metric, select a
reference reflection profile closest to the generated reflection profile, and determine the
dimension of the grid based on the grid dimension metric associated with the selected
reference reflection profile.

34. The processing line of claim 32, wherein the detector is further adapted to
generate the reflection profile based on at least one of intensity and phase of the reflected
light.

35. The processing line of claim 32, wherein the metrology tool comprises at least
one of a scatterometer, an ellipsometer, and a reflectometer.

36. The processing line of claim 32, wherein the data processing unit is further
adapted to compare the generated reflection profile to a target reflection profile and

determine the dimension of the grid based on the comparison of the generated reflection profile and the target reflection profile.

37. The processing line of claim 32, wherein the processing tool further comprises an etch tool, and the controller is further adapted to determine at least one of an etch time parameter, a plasma chemical composition parameter, an RF power parameter, a gas flow parameter, a chamber temperature parameter, a chamber pressure parameter, and an end-point signal parameter.

38. The processing line of claim 32, wherein the processing tool further comprises a photolithography tool, and the controller is further adapted to determine at least one of an exposure time parameter, an exposure dose parameter, a depth of focus parameter, a resist spin speed parameter, a soft bake temperature parameter, a post exposure bake temperature parameter, a cool plate temperature parameter, a developer temperature parameter, and a focus tilt parameter.

39. The processing line of claim 32, wherein the controller is further adapted to identify a fault condition associated with the grid based on the determined grid dimension.

40. A metrology tool adapted to receive a wafer having a test structure comprising a plurality of intersecting lines that define a grid having openings, comprising:

a light source adapted to illuminate at least a portion of the grid;

a detector adapted to measure light reflected from the illuminated portion of the grid to generate a reflection profile; and

a data processing unit adapted to compare the generated reflection profile to a library of reference reflection profiles, each reference reflection profile having an associated grid dimension metric, select a reference reflection profile closest to the generated reflection profile, and determine a dimension of the grid based on the grid dimension metric associated with the selected reference reflection profile.

41. A metrology tool adapted to receive a wafer having a test structure comprising a plurality of intersecting lines that define a grid having openings; a plurality of trenches, comprising:

a light source adapted to illuminate at least a portion of the grid;
a detector adapted to measure light reflected from the illuminated portion of the grid to generate a reflection profile; and
a data processing unit adapted to compare the generated reflection profile to a target reflection profile and determine a dimension of the grid based on the comparison of the generated reflection profile and the target reflection profile.

42. A test structure, comprising:

a first plurality of lines; and
a second plurality of lines intersecting the first plurality of lines, the first and second pluralities of lines defining a grid having openings.

43. The test structure of claim 42, further comprising a process layer, the grid being defined in the process layer.

44. The test structure of claim 42, wherein the process layer comprises at least one of a photoresist layer, a substrate layer, an insulative layer, and a conductive layer.

45. A metrology tool, comprising:

means for receiving a wafer having a test structure comprising a plurality of intersecting lines that define a grid having openings;

means for illuminating at least a portion of the grid with a light source;

means for measuring light reflected from the illuminated portion of the grid to generate a reflection profile; and

means for determining a dimension of the grid based on the reflection profile.

46. The metrology tool of claim 45, further comprising:

means for comparing the generated reflection profile to a library of reference reflection profiles, each reference reflection profile having an associated grid dimension metric;

means for selecting a reference reflection profile closest to the generated reflection profile; and

means for determining the dimension of the grid based on the grid dimension metric associated with the selected reference reflection profile.

47. The metrology tool of claim 45, further comprising:

means for comparing the generated reflection profile to a target reflection profile; and

means for determining the dimension of the grid based on the comparison of the generated reflection profile and the target reflection profile.